

NOTE ON LOWEST ANTARCTIC TEMPERATURE ESTIMATED BY SHLIAKHOV

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In the preceding note, Miss Stepanova referred to Shliakhov's estimate of lowest Antarctic temperature [1] which has been proven too high by subsequent events. It appears that the basic error committed by Shliakhov is in the association of a zero radiation balance with a certain temperature—the theoretical minimum. This is not true within the likely range of atmospheric temperatures because of the water-vapor absorption spectrum with its "window" near the maximum of the black-body radiation spectrum. As explained in an earlier paper [2], although the surface temperature may reach a state of "quasi-radiative equilibrium" wherein the back atmospheric radiation exactly equals the upcoming radiation from the surface, the surface temperature continues to fall for the following reason: All of the back radiation from the atmosphere is absorbed by the snow surface which acts as a black-body for infrared radiation but not all of the upcoming radiation is absorbed by the atmosphere which is not a black-body. Consequently there is a net loss of energy in the atmosphere which cools and then sends less back radiation to the surface, which then cools also, and so on.

Shliakhov essentially attempts to calculate this effect and comes to the conclusion that it could only change the temperature of the lowest 3 km. by 1° C. in 200 hours, or 8.4 days, and neglects it in the calculation of the theoretical minimum temperature. But as the data in Stepanova's table 1 show, the succession of minimum temperatures proceeds so slowly with time that a cooling rate of 1° C. per 8.4 days cannot be neglected.

McCormick [3] has shown that in the absence of advective and conductive processes the theoretical minimum could be -200° C. in 180 sunless days at the South Pole.

REFERENCES

1. V. I. Shliakhov, "O Minimal'nykh temperaturakh v Antarktide" (On Minimum Temperatures in Antarctica), *Meteorologiya i Gidrologiya*, No. 4, 1958, pp. 5-7.
2. H. Wexler, "Cooling in the Lower Atmosphere and the Structure of Polar Continental Air," *Monthly Weather Review*, vol. 64, No. 4, April 1936, pp. 122-136.
3. R. A. McCormick, "An Estimate of the Minimum Possible Surface Temperature at the South Pole," *Monthly Weather Review*, vol. 86, No. 1, Jan. 1958, pp. 1-5.